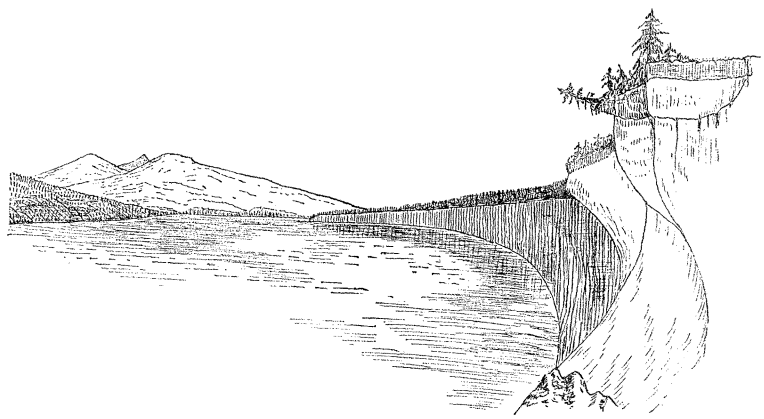
me here. I have tried, as I said I would, to put in the simplest way before you some considerations which appear to me as of present importance in our science, both in the old world and in the new, and I thank you in the heartiest way possible for the opportunity you have given me to do this.

EXPLORATION OF THE KOWAK RIVER.

WE have been favored by Major E. W. Clark, chief of the Revenue marine bureau, with the following abstract of explorations on the Kowak or Kuak River of Alaska, made during the season of 1884 by a party from the U. S. steamer Corwin, Capt. Healy. The party comprised Lieut. J. C. Cantwell, commanding, assisted by Second-Assistant Engineer S. B. McLenegan, a quartermaster, fireman, miner, and interpreter, and was furnished with two small boats and the Corwin's steam-launch. They left the Corwin at Cape Krusenstern, July 8, and the following morning entered Hotham Inlet by a practicable channel four or five fathoms deep, which enters the inlet close to its eastern point or headland. The eastern and southern shores of the inlet are composed of clay bluffs about two hundred feet high, backed by rolling tundra. The opposite shore, however, was low and swampy, with many lagoons, the native guide stating that this was the Kowak delta, which has fifteen mouths, and extends some fifty miles inland. The temperature at this time averaged 80° or 90° F. during the day. At seven o'clock on the 10th of July a break was seen in the lowland of the delta, where a high peak ahead and a high bluff point on the western shore form a range for the channel entering the river. The channel is about two hundred yards wide, with two and a half fathoms least water at the time the party entered. The banks are low and marshy, with a dense growth of willow and birch, and harbored myriads of mosquitoes. At ten A.M. next day a collection of Innuit huts was seen, tenanted by only one family at that date. The banks of the river, hitherto uniformly low, began to be more elevated, and the current increased to three miles per hour. The course of the river was extremely tortuous. Another village was seen on the left bank, on a high black bluff, at four P.M. The depth of the river increased to five fathoms: its width varied, being from half to three-quarters of a mile. Many offshoots of the main stream were noticed, all extending to the northward and westward. The following day a good growth of pine, birch, and willow adorned the banks, which had previously shown only shrubbery. At half-past eight A.M. a large westerly arm was passed, which, according to the native guide, was the last arm of the delta, and flowed into the western part of Hotham Inlet. At noon the party obtained observations, placing them in latitude 68° 45′.3, and west longitude 161° 46′. At half-past two P.M. a series of ice-cliffs, like those of Eschscholtz Bay, was observed, composed of a solid mass of ice extending three-quarters of a mile along the left bank, covered by a thin layer of dark-colored earth, and rising to a height of a hundred and fifty feet. Trees were growing on the surface. Up to this point, and for some distance farther, not a single stone or pebble was to be seen, and the silence was frequently disturbed by the fall of large masses of the soft earthy banks undermined by the strong current. On the afternoon of the 13th a stretch of river extending about six miles in a north-easterly direction was reached, which offered a beautiful prospect. The river widened to half a mile, with low green banks, while beyond a range of rugged mountains could be seen. At the end of the six-mile reach was a succession of high bluffs, caused by the foot-hills coming down to the river, with a narrow, rocky beach, the slopes wooded with pine and juniper. There were many very fragrant wild-flowers, and the mosquitoes were the only disturbing element. This, which was named Highland Camp, was about eighty miles from the entrance of the river. About one P.M., on the 14th of July, the mouth of the Squirrel River of the natives was reached, coming in from the north-east. Its source



ICE-CLIFFS ON KOWAK RIVER.

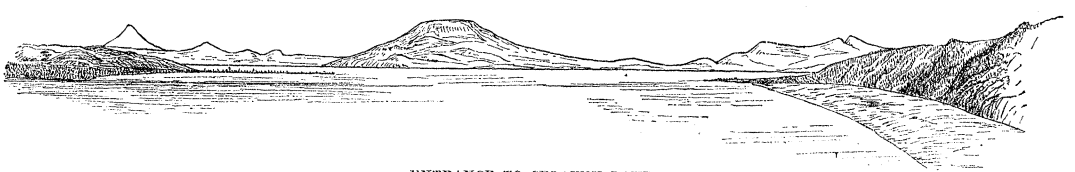
is in the mountains, one day's portage from the Nunatok, or some of its branches. Here three nearly equal waterways presented themselves, of which the middle one was chosen. The strength of the current made progress very difficult, and there were numerous bars. The right bank was high and rolling to the water side, where it formed a beach of variously colored limestone pebbles. Large masses of metamorphic rock cropped out among the dense growth of forest which lined the shore. On the left bank the land was low, being an island some ten miles long, whose upper end was reached about six P.M. On the following morning the river widened, the current became less, and the stream less crooked, and it was apparent that the party had passed the region of the mountains through which the river cuts its way. These mountains beyond the right bank rise over three thousand feet, heavily timbered at their bases, and trend nearly as the river runs. In the afternoon a large coal-vein was discovered in a bluff on the river-bank, and was extremely welcome for use in the steam-launch, though that on the surface had been weathered so as to partly impair its good quality.

This and the following day were rainy: so no observation could be had. The thermometer stood at about 90° F. At half-past six a deserted village was reached. The width of the river was from five hundred to nine hundred yards, and the depth of the channel from twelve to thirty feet. The following day another deposit of coal in a stratum of fine white clay suitable for pottery was found. This coal, however, did not burn well, probably on account of the admixture of clay. Later in the day the first rapids were reached, and passed with some difficulty; and in the evening the party halted at a fishing-village, where the natives, who were very honest and friendly, were preparing their nets for the expected run of salmon. As progress was made, the current became extremely strong, numerous rocks were found to exist alongshore, and it required much care to keep the launch from being thrown upon them by the force of the stream. Several villages and fishing-stations were passed, and small ripples or rapids became more numerous, so that the lighter boats easily outstripped the launch. On the 21st, having nearly reached the Jade Mountain, it was determined to divide the party, let the engineer and miner explore in the vicinity, while the launch was taken to a convenient spot for laying her up by Lieut. Cantwell, who would then rejoin them. The launch was left at a fishing-village, whose inhabitants informed them that the channel of the river above soon became obstructed by rocks, and ran in a sort of cañon, so that the natives do not attempt to navigate it. It divides into two branches, one of which takes its rise in a large lake (supposed to be twenty-five miles long), while the other rises farther to the eastward, near the head waters of the Koyukuk River, which enters the Yukon just above Nulato. The natives use birch canoes in this region. The river rose one foot during the night of the 22d; and the Innuit stated that the water was very high, but later, with dry weather, would fall, so that all the river-bed would be dry except the channel. Lieut. Cantwell, after repairing the furnace of the launch with the native fire-clay, left her to rejoin McLenegan and Miller with a party of Innuit. They were reached on the 24th, much exhausted by their trip, their boots worn out, pestered to an incredible degree by mosquitoes, but bringing some of the native jade and other minerals. They were sent to recuperate at the station where the launch had been left, while the others pushed on, and at noon reached a part of the river where it takes a sudden bend to the south-east, the country being low and rolling, backed by mountains on both sides. The Jade Mountain could be readily distinguished from the other peaks by its greenish color. The depth of water did not diminish. At half-past four P.M. a remarkable clay bluff, three-quarters of a mile long and a hundred and fifty feet high, was reached on the left bank of the river. Quantities of mammoth tusks were observed in this clay and its *débris* where undermined by the stream. The river now becomes very tortuous, with many islands, and tundra extending to the mountains. The soil is clayey, with a thick layer of black mould. In winter the natives, who at this time were fishing on the lower Kowak, ascend to the region of its head waters, and travel to trade with the Yukon Indians, *viâ* the Koyukuk River, or go still farther to the north-east to the range of the high Yukon Mountains, where moose and mountain sheep are found in great numbers. It was reported that on a clear day the sea (or a large lake) could be seen from these mountains in one direction. On the other side of the Yukon range is a river (doubtless the Colville) by which the sea can be reached in five days. On the 26th of July a point was reached where the river divides into two parts, the south-eastern of which was followed, on account of its more direct course, to a point where the Umakalūkta River comes in from the southward. This was narrow and crooked, soon diminishing to a mere torrent. Trees two feet in diameter, and very rank shrubbery, were observed on its banks. It was ascended to a village about twenty miles above its mouth, where the explorers were kindly welcomed by the inhabitants, some of whom had never seen a white man before. Boats could not be obtained here to replace the water-soaked skin-boat of the party; but they were told that they could from this place make a portage across to the Kowak, which they would reach from twenty-five to thirty miles above the point where the Umakalūkta joins it. This was determined upon, and the party camped at the village, enjoying some delicious fresh salmon.

The following day the portage was made over a hill to a small lake, then over tundra to a large lake which took four hours to cross, and then through a swamp to the Kowak again. For reasons connected with the supply of provisions and the worn state of the skin boat upon which the party depended for transportation, it was decided to return to the launch. It was supposed that there were, by native reckoning, about twelve days' farther navigation to the falls,

which terminated the navigable part of the river, which would now diminish in depth with every day of fine weather. From a hill near the camp, the river could be seen, winding along the foot of the mountains and off into level country beyond, while in the far distance snowy peaks were seen, from which the natives reported that the other peaks in which the Kowak takes its source could be seen on a clear day. At seven A.M., July 29, the party started down the river, descending with great velocity on the swift current. The mouth of the Notmoktowak or 'Pack' River, which drains the country between the Nunatok and Kowak, was examined, and the boat passed through several sloughs not observed in coming up. The boat leaked and needed repairs: so on the 30th Lieut. Cantwell left it to be mended, and started for the Jade Mountain, twelve miles away, on foot. The natives refused to accompany him, as the shaman declared evil would come to any one who visited the mountain. The tramp was fatiguing; but a torrent was reached which separates the mountain from a high, rugged peak of the same range. Large quantities of the green stone were found in the bed of the stream; but the mountain itself seemed actually to be entirely composed of it, and the sides of the cliffs were like polished glass for smoothness where they had been subjected to pressure or wear. About a hundred pounds of the mineral were collected; and, after a short nap, the party returned to the river, which they reached, almost exhausted by the heat, the bad travelling, and the torture of sand-flies and mosquitoes. On the 2d of August the party started down to meet the launch, whose boilers were so worn that she could not with safety attempt much more hard steaming against the current. Observations for position and declination were obtained at various points; and on the 6th of August, at two A.M., the party reached Highland Camp, where sundry articles collected on the up-trip were taken on board. On the following day the party camped on the shores of Hotham Inlet. The distance travelled up the river, including all tortuosities, was estimated at three hundred and seventy miles.

The remainder of their stay was devoted to the exploration of Hotham Inlet and Selawik Lake, and its associated rivers and lakes, during which some extremely valuable corrections to the charts were made. Selawik Lake is practically an extension through a narrow passage of Hotham Inlet. The main mouth of the Kowak River empties into the inlet close to the entrance of the lake, which on the south side is marked by a sand-spit projecting far out from the shore, forming a convenient boat harbor. The lake along its south shore is not very deep, and shoals off very gradually, so as to make landing difficult. The country is high, rolling tundra, forming a bluff bank behind the beach, covered with a thick growth of shrubbery. At intervals long spits extend far out from the shore, forming many small harbors or bays. The eastern end of the lake, where the shore trends to the north-west, is low and swampy, and the water very shoal, with a sort of bar parallel with the beach two hundred yards off. Here were myriads of water-fowl. A river comes in from the eastward about seventy-five yards wide, with from twelve to eighteen feet of water. This flows from a lovely little lake about five miles in diameter, almost entirely surrounded by mountains. A narrow creek enters the opposite side of the lake, and, ascending this, the large lake, Imogarik-cho-it, or Little Sea, of the natives is reached. The stream connecting this with Selawik Lake is called Kiaktuk or Fox River. The mountains visible from Selawik Lake border the eastern shore of Imogarik Lake, and extend nearly round it; but the northerly shore is quite low and marshy. Another branch, called the Igaiak River, connects Imogarik Lake and Selawik River about twenty-five miles from the mouth of the latter, by which Selawik Lake could be reached in two days. This was taken, and the junction of the Selawik and Igaiak rivers reached on the morning of Aug. 14. The banks of the Selawik differ little from those of the Kowak, except that the undergrowth is heavier. The width of the river varies from six hundred to a thousand yards, and in some places expands into bays a mile wide. The channel showed from four to six fathoms. From the mouth of the Igaiak, the Selawik trends about six miles in a north-westerly direction, and then south and west to Selawik Lake. Many small lakes and lagoons were observed near the river, and from a hill one large sheet of water was seen which lay near the foot of the mountains, about six miles from the river. That evening Selawik Lake was reached through a large bay filled with many islands, and the party camped on a sand-spit which formed the north point of entrance to the lake. About halfway from the river to the inlet a river comes into the lake from the mountains between the latter and the valley of the Kowak. The country here is low and marshy. The work was completed Aug. 16, and the party started down Hotham Inlet, of which a reconnoissance was made on their way. The bar at the mouth of Hotham Inlet was found to have no more than six feet of water on it anywhere at low water. On the 30th of August the party rejoined the Corwin about fifteen miles westward from Cape Blossom,



ENTRANCE TO SELAWIK LAKE.

and reported for duty without serious accident or illness of any of its members.

Reports on the minerals, birds, general character of the country and its inhabitants, the fur trade, etc., from Engineer McLenegan, accompany the report to Capt. Healy, commander of the Corwin, from which the above notes are derived. The Kowak abounds in salmon, pike, and white-fish, which are dried by the natives. The white spruce is the largest and most abundant tree. The natives are all Innuit or Eskimo; and their numbers in this region are estimated at three hundred and fifty on the Nunatok, two hundred and twenty-five on the Kowak, and two hundred and fifty on the Selawik lakes and rivers. The coal-belt is about thirty miles wide, and is probably lignitic, resembling the small seam near Nulato, on the Yukon. The 'color' of gold was obtained almost everywhere, but it is doubtful if it would pay to work it. Beds of a beautifully mottled serpentine, used by the natives for ornaments, were found in the mountains near the Kowak, as well as the so-called 'jade,' used far and wide for the most costly and elegant stone implements, which is perhaps the variety of pectolite recently described by Clarke from specimens got at Point Barrow. Seventy-seven species of birds were collected, mostly of species common to the Yukon region, among which the rock ptarmigan and white-tailed godwit (L. uropygialis?) are noteworthy, as well as the great white-billed loon (C. Adamsi).

Commercially the most important result of the expedition is the indication of a route by which whalers or others, held by the ice eastward from Point Barrow, might find a comparatively available way to the settlements on the Yukon, *viâ* the Colville and Kowak rivers, and through the Koyukuk valley. Geographically the journey of Lieut. Cantwell is the most important of the past year in America; and its results, taken in connection with those of Lieut. Stoney, who subsequently passed over nearly the same route, will give us an approximate knowledge of a considerable area which has hitherto been almost a blank upon the best maps.

THE CHOLERA BACILLUS. — KOCH'S REPLY TO HIS CRITICS.

THE doubts that have arisen in many minds in regard to the specific nature of the cholera bacillus of Koch may be in some measure dispelled by the latter's answers to his critics in a recent number of the *Deutsche medicinische wochenschrift* (No. 45, 1884). In it he shows the differences between the cholera bacillus and that found in the mouth (*Lancet*, Sept. 20, 1884), and then takes up the work of Finkler and Pryor. He shows that they have not obtained pure cultures (this from specimens of their own); that their bacillus is larger and thicker, more rapid in growth, and very different in 'culture-form.' In examinations of three cases of 'cholera nostras,' he failed to find the 'comma bacillus.' Koch has also succeeded in producing cholera by the inoculation of one one-hundredth of a drop of a solution of a pure culture. This produced death in rabbits and guinea-pigs in from one and a half to three days, when placed in the duodenum. The appearances *post mortem* were those of the human subject in death from Asiatic cholera.

In addition to this, we have the confirmatory evidence of E. van Ermengen in a communication to the Belgian microscopical society, Oct. 26, 1884 (*Lancet*, Nov. 29, 1884). This observer found the comma bacillus in the intestinal fluids of eight autopsies and thirty-four examinations of stools. He considers that its peculiar-shaped, chain-like groups and occasional wavy filaments distinguish it completely from other bacteria. He finds that it is more or less abundant, according to the stage of the disease; and in two cases (*foudroyant*) they were present almost as in a pure culture. They disappear during reaction.

Premonitory diarrhoea was not investigated for the presence of the organism, for lack of time. In cases of algide cholera, where no bacilli were found in the stools, culture of the most minute portion produced enormous numbers of the organism within twenty-four hours. He considers that the presence of the organism is diagnostic of cholera, and that the method of microscopic examination in conjunction with cultures should be adopted in all doubtful cases. By thus settling the diagnosis early, efficient prophylaxis against the spread of the disease may be established. He found no spores, and considers their absence probably established by the want of resistance to drying of this organism. He finds precisely the same differences between the cholera bacillus and those of Lewis and of Finkler and Pryor, and exactly the same objections to the latter's work, as does Koch (*loc. cit.*). He, as well as Koch, succeeded in producing cholera by inoculation of one drop of a culture, extending over four days (this in dogs, guinea-pigs, and rabbits). The cadaveric appearances were those of cholera; and the intestinal fluids contained many comma bacilli, from which further cultures were made. He thinks that the pathogenic action of these bacteria is very likely due to some product of their growth in the material in which they are sown, and closes his communication by advising that physicians generally should be instructed in the methods of microscopic search for these organisms in order to the early determination of the existence of the disease, and all that that implies. This is a recommendation which might be made in this country, and adopted with much benefit to the community at large.

Such observations as these furnish strong evidence that the world is again indebted to Koch for his labors in the investigation of disease, and that the links connecting his cholera bacillus with cholera as its specific cause are being forged into a complete chain of evidence.

In regard to the organism itself, we have received within a day or two a slide containing masses of bacilli from a pure culture. The preparation is a very beautiful one; and its authenticity is undoubt-